

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A rate controlling method for computing a reference quantization parameter, used in a transcoder having a variable length decoder, an inverse quantizer, a quantizer and a variable length encoder, the rate controlling method comprising:

receiving an input quantization parameter and motion information for each of the macroblocks from the variable length decoder;

analyzing the similarity of motion information between a current macroblock and its neighboring macroblocks to compute a scaling factor for the current macroblock when allocated within P- and B-pictures;

computing a bit difference between a target outputting bit stream and a real outputting bit stream from the variable length encoder;

estimating the fullness of a virtual buffer to encode the current macroblock in view of the scaling factor; and

computing the reference parameter based on a target bit rate, the first quantization parameter and the bit difference;

wherein said motion information is a motion vector, and said scaling factor is defined as the following:

$$d_{factor} = 1 + \text{sign}(MV(j) \cdot MV_{median}) \cdot \frac{(MV(j) \cdot MV_{median})}{(|MV(j)| \cdot |MV_{median}|)}$$
$$\text{sign}(a) = \begin{cases} 1 & \text{if } a \geq 0 \\ -1 & \text{if } a < 0 \end{cases}$$

where "." is operator for inner product, MV is the motion vector of the current macroblock, and MV_{median} is the median of the motion vectors of its neighboring macroblocks.

2-3. (Cancelled)

4. (Currently Amended) A rate controller for computing a reference quantization parameter, used in a transcoder having a variable length decoder, an inverse quantizer, a quantizer and a variable length encoder, the rate controller comprising:

means for receiving an input quantization parameter and motion information for each of the macroblocks from the variable length decoder;

a motion analyzer for analyzing the similarity of motion information between a current macroblock and its neighboring macroblocks to compute a scaling factor for the current macroblock when allocated within P- and B-pictures;

a remaining bit counting unit for computing a bit difference between a target outputting bit stream and a real outputting bit stream from the variable length encoder; and

a quantization parameter computing unit for estimating the fullness of a virtual buffer to encode the current macroblock in view of the scaling factor, and computing the reference parameter based on a target bit rate, the first quantization parameter and the bit difference;

wherein said motion information is a motion vector, and said scaling factor is defined as the following:

$$d_{factor} = 1 + \text{sign}(MV(j) \cdot MV_{median}) \cdot \frac{(MV(j) \cdot MV_{median})}{(|MV(j)| \cdot |MV_{median}|)}$$
$$\text{sign}(a) = \begin{cases} 1 & \text{if } a \geq 0 \\ -1 & \text{if } a < 0 \end{cases}$$

where "." is operator for inner product, MV is the motion vector of the current macroblock, and MV_{median} is the median of the motion vectors of its neighboring macroblocks.

5-6. (Cancelled)

7. (Currently Amended) A computer readable medium with a computer program stored therein, the computer program, when run on a computer, executing a rate controlling method for computing a reference quantization parameter, the rate controlling method used in a transcoder having a variable length decoder, an inverse quantizer, a quantizer and a variable length encoder, the rate controlling method comprising:

receiving an input quantization parameter and motion information for each of the macroblocks from the variable length decoder;

analyzing the similarity of motion information between a current macroblock and its neighboring macroblocks to compute a scaling factor for the current macroblock when allocated within P- and B-pictures;

computing a bit difference between a target outputting bit stream and a real outputting bit stream from the variable length encoder;

estimating the fullness of a virtual buffer to encode the current macroblock in view of the scaling factor; and

computing the reference parameter based on a target bit rate, the first quantization parameter and the bit difference;

wherein said motion information is a motion vector, and said scaling factor is defined as the following:

$$d_{factor} = 1 + \text{sign}(MV(j) \cdot MV_{median}) \cdot \frac{(MV(j) \cdot MV_{median})}{(|MV(j)| \cdot |MV_{median}|)}$$
$$\text{sign}(a) = \begin{cases} 1 & \text{if } a \geq 0 \\ -1 & \text{if } a < 0 \end{cases}$$

where "." is operator for inner product, MV is the motion vector of the current macroblock, and MV_{median} is the median of the motion vectors of its neighboring macroblocks.